DEPARTMENT OF THE ARMY
EUROPEAN DIVISION CORPS OF ENGINEERS

ENERGY ENGINEERING ANALYSIS PROGRAM EUROPE

WILDFLECKEN MILITARY SUBCOMMUNITY

FIFTH CORPS

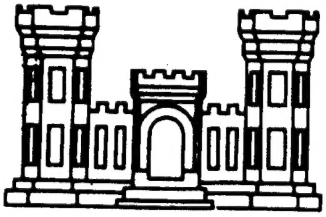
WEST GERMANY

Final Submittal

VOLUME I

EXECUTIVE SUMMARY

UNITED STATES ARMY
CORPS OF ENGINEERS
EUROPEAN DIVISION



FEBRUARY 1983

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FY 80 ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE

FINAL SUBMITTAL

FEBRUARY 1983

THE FINAL SUBMITTAL CONSISTS OF TWO SEPARATE VOLUMES:

- VOLUME I EXECUTIVE SUMMARY
- VOLUME II ENERGY REPORT

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FY 80 ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE

WILDFLECKEN

FINAL SUBMITTAL

VOLUME I

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

WILDFLECKEN

1. INTRODUCTION

The Energy Engineering Analysis Program for the three U. S. Military Subcommunities of Vilseck, Hohenfels and Wildflecken in West Germany, has been authorized by the Department of the Army European Division, Corps of Engineers under Contract No. DACA90-80-C-0093 dated September 29, 1980, and subsequent Modifications:

P00001 dated April 27, 1981,
P00002 dated September 29, 1981, and
P00003 dated September 30, 1981.

1.1 OBJECTIVES OF THE ENERGY STUDY

The objectives of this contract, as explained in detail in Schedule of Title I Services for Energy Engineering Analysis Program, Europe dated September 18, 1981, are as follows:

a. Develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan.

b. Use and incorporate applicable data and results of related studies, past and current, as feasible.

c. Develop a coordinated basewide energy study.

d. Prepare Program Development Brochures (PDB), DD Forms 1391, and supporting documentation for feasible energy conservation projects.

e. Include all methods of energy conservation which are practical (in so far as the state-of-the-art is reasonably firm) and economically feasible in accordance with guidance given.

f. List and prioritize all recommended energy conservation projects.

1.2 INCREMENTS OF WORK

The work to be performed under the contract has been divided into four Increments: A, B, F and G.

Increment A - Energy conservation investigations for buildings and processes.

Increment B - Energy conservation investigations of utilities and energy distribution systems, Energy Monitoring and Control Systems (EMCS), and existing energy plant investigations.

Increment F - Facilities Engineer conservation measures.

Increment G - Projects identified in Increments A and B that do not meet the ECIP criteria of E/C> 13, but may qualify as OMA or MMCA Projects.

1.3 PHASES OF WORK

Increments A, B, F and G have been divided into three phases of work:

Phase I Data gathering and field trips.

Phase II Analysis of data, identification of potential projects, performance of feasibility and economic studies, and preparation of first page of DD Form 1391.

During this phase, all potential projects which produce energy and/or dollar savings should be identified and evaluated as to technical and economic feasibility.

Projects determined to be technically and economically feasible shall be combined into projects and ranked according to highest E/C ratio.

For FY 84, the minimum E/C = 13 MBtu/k$

Phase III Preparation of DD Form 1391 and Project Development Brochures (PDBs); and preparation of documents presenting the results and recommendations of the study. DD Forms 1391 and PDB's are nor required for Increment F.

As a result of Modifications P00002 dated 29 September 1981, and P00003 dated November 2, 1981, it was negotiated that the Interim Submittal would not contain the Phase II effort of the EMCS study, nor the Phase I and Phase II efforts of Increment F. These would be included in the Prefinal Submittal, after additional required data is obtained by surveying all three subcommunities in early 1982.

1.4 PRESENT STATUS OF THE PROJECT

1.4.1 SURVEY

Prior to the commencement of Phase I of the project, a meeting was held between the A-E and the Corps of Engineers, and out of the approximately 200 energy consuming buildings at Wildflecken, 63 buildings were selected to be surveyed in detail.

It was agreed that the sample selected was representative of the entire community; and that the results of the survey and subsequent analysis of energy consumption and energy savings based on a representative building per type at each community could be extrapolated to obtain the energy consumption, energy savings and implementation cost for the entire community, based on the total square foot area of all buildings of each given type.

By this extrapolation method, values of basewide energy consumption, energy savings, and implementation costs could be estimated; and basewide ECIP projects determined.

1.4.2 PRELIMINARY SUBMITTAL

The work listed below was accomplished and presented in the Preliminary Submittal:

a. Compilation and analysis of the data and information received from each subcommunity.

b. Review of the actual energy consumption of each subcommunity based on the energy consumption data collected; as well as a presentation of the projected energy consumption goals for each subcommunity based on the Army Facilities Energy Plan.

c. Summarized tabulations of the survey data.

d. Data of the surveyed buildings was input on Computer Program AXCESS.

e. As a "sample-pilot" ECIP analysis, one building type was selected and analyzed for energy conservation in detail.

f. The feasibility of Central Boiler Plant Projects was investigated.

The presentation of the Preliminary Submittal for Wildflecken was made on 30 July, 1981 at Grafenwoehr.

Review comments on the Preliminary Submittal were forwarded to the AE by the Project Manager in his letter dated 15 October, 1981.

1.4.3 INTERIM SUBMITTAL

The work listed below was accomplished and presented in the Interim Submittal:

a. The data received from the Subcommunity was updated.

b. Review of the actual energy consumption of the Subcommunity based on the energy consumption data collected; and a presentation of the energy consumption goals for the Subcommunity based on the Army Facilities Energy Plan.

c. We presented an updated list of the representative buildings of each type selected for detailed energy conservation analysis.

d. The Computer Program AXCESS was used to model and analyze all the buildings surveyed at the Subcommunity. Quantitative results of monthly energy consumption for space heating, domestic hot water, lighting and miscellaneous electricity usage has been obtained for each type of building.

e. Increment A: Each of the buildings types was analyzed for energy conservation opportunities (ECOs) that involved modifying, improving or retrofitting the architectural features, HVAC systems, plumbing systems and lighting.

ECOs determined to be technically and economically feasible (E/C>13, B/C>1) were combined into Energy Conservation Projects (ECP's), and extrapolated to Energy Conservation Investment Projects (ECIP's).

f. Increment G: Projects considered in Increment A that did not meet the E/C>13 criteria and yet had a B/C>1 were recommended for implementation under OMA or MMCA funding.

A complete DD Form 1391 and complete PDB-I were presented for approval.

DD Form 1391s and PDBs are not required for Increment F.

g. Increment B: Information obtained on utilities and energy distribution systems, and existing energy plants (boilers) was presented and possible energy conservation measures analyzed.

1.4.4 MODIFICATIONS P00002 AND P00003

These two modifications were negotiated and signed in September 1981.

It was agreed that the AE would perform a walk-through survey of every building in the community for Increment F's requirement to "provide recommendations for modifications and changes in system operation which are within the Facilities Engineer funding authority and management control", as well as for Increment B's EMCS analysis.

Only buildings larger than 5,000 GSF in area and consuming greater than 7500 gal/yr. of oil or 45 m-ton of coal or having a minimum 10 kw connected electrical load would be analyzed for EMCS feasibility.

The survey effort would be performed in early 1982.

1.4.5 PREFINAL SUMBITTAL, INCREMENT F

180 sets of field survey forms were reviewed and from these a computer input sheet for each building surveyed was prepared. A computer data library was created storing all information gathered in the field which could be relevant to recommendations under investigation.

Tables 6-1 and 6-2 of Volume 2, the Energy Report, list the relevent data.

Computer aided manual calculations were used to obtain unescalated energy and cost savings and implementation costs. A computerized economic analysis program was used to produce E/C and B/C ratios.

Recent American and German Manufacturer's catalog data was obtained and included in the Appendices, Volume 7 of the Prefinal Submittal.

1.4.5.1 RECOMMENDATIONS

All recommended energy conserving modifications are presented in Sections 7 and 8 of the Increment F Narrative, Prefinal Submittal. These sections are now included as Sections 8.7 and 8.8 of Volume 2, Energy Report.

A summary sheet for each Section 7 recommendations (Modification to Building Systems) includes the following:

a. A brief description of reasons for the modification.

b. Instructions for accomplishing the modification.

c. An estimate of labor and material costs.

d. An estimate of man-hours listed by trade, where relevant.

e. The estimated dollar and energy savings.

f. The results of an economic analysis: E/C AND B/C ratios.

The analyses of Section 8 recommendations (Modifications to M/O Systems) are contained within the Increment F Narrative, Prefinal Submittal.

A Summary of all modifications for Increment F listing costs, man-hours, dollar and energy savings was prepared and is presented in Table 2-1 of the Increment F Narrative, Prefinal Submittal. A copy can be found in Section 4 of this Volume. The Table lists the modfications in order from highest to lowest E/C ratio.

All energy conserving projects from Increments A, B and G and recommendations from Increment F have been consolidated, priority ranked and presented in Table 10-1 of the Increment F Narrative. Order of priority is from highest to lowest E/C ratio. A copy can be found at the end of this section.

Energy related areas of operation for which additional training of Facilities Engineering personnel is recommended has been listed in Section 12 of the Increment F Narrative.

Expendable equipment which should be changed to higher efficiency types when the next replacement occurs has been investigated. Recommendations are included in Section 13 of the Increment F Narrative, Prefinal Submittal.

1.4.6 PREFINAL SUBMITTAL, INCREMENT B

Work listed below was accomplished and submitted for Increment B, excluding EMCS:

a. We have obtained information on and studied in significant detail the subcommunities electrical system, street lighting system, potable water system, sewage collection and treatment system, hot water and steam distribution system; as well as existing energy plants consisting of Central Boiler Plants and Local-Building Boiler Plants.

b. We have recommended several projects that require the modification of boiler plant controls such as installation of OA HW reset control, night set-back control and installation of time-clock. These projects however, have been presented under Increments A or G.

c. We have developed electricity and fuel consumption load profiles for the past three years and presented them in Section 3.

d. Graphical profiles of hourly KW demand occuring on a weekday, weekend and peak demand day have been developed, presented and discussed in Paragrpah 7.2.4 for each month of FY 80. We have discussed existing peak demand limiting systems, and will investigate if the EMCS is feasible for further demand limiting.

e. Based on the AXCESS analysis of each building type, we have estimated the annual energy consumption and cost per square foot of each building type for Electricity, Fuel, Space Heating, Domestic Hot Water, Lighting and Miscellaneous Equipment. We have also projected these FY 80 to FY 84. Tabulated cost data has been presented in Section 5.

Work listed below was accomplished and submitted for Increment B, EMCS:

a. Supplement the site investigation with "as built" drawings, as well as sound engineering judgment.

b. Interview administrative personnel to determine operating hours and procedures relative to the surveyed buildings.

c. Identify EMCS energy conserving programs and strategies which might be appropriate for each of the buildings, listing the points required.

d. Evaluate by computer analysis, energy conserved by these programs as well as their implementation costs in accordance with Energy Conservation Investment Program (ECIP) requirements.

e. Make recommendations which may include in the EMCS some systems, points and/or programs which, while not directly related to energy savings, would provide management information and centralized control, making for more efficient facility operation.

1.4.7 FINAL SUMBITTAL

During the period January 13, 1983 through February 12, 1983, the Preliminary, Interim and Prefinal Submittals have been compiled into a Final Submittal. A description of the compilation is as follows:

a. For Sections 1 through 7 of the Final Submittal, the Interim Narrative was used as the basic text. Relevant material from the Preliminary was included.

b. Section 8 incorporates Sections 1 through 8 and 12 through 14 of the Increment F Narrative.

c. Sections 9 through 11 incorporates Sections 9 through 11 of the Increment F Narrative.

d. Section 12 incorporates the Increment B, EMCS Feasibility Study of the Prefinal Submittal.

The Final Submittal Executive Summary is made up of the Interim and the Prefinal Executive Summaries. These summaries have been adapted and brought up to date where necessary. The Final Submittal Executive Summary has been compiled as follows:

a. For Sections 1 through 4 the Prefinal Executive Summary, Sections 1 through 4, have been used.

b. For Sections 5 through 8 the Interim Executive Summary, Sections 2 through 5, have been used.

1.5 CONCLUSIONS

1.5.1 SAVINGS RESULTING FROM IMPLEMENTED ECO'S

The effects, in energy and cost savings, of implementing all Increment A, B, C, & G projects are summarized in Table 10-1, a copy of which is included hereafter. The percent savings for these projects are obtained using the known consumption for FY 75 from Table 3.3-2. This table is presented in Section 7. The total consumption for that year is 410,398 MBtu.

Increment A projects save 25,501 MBtu/yr, or 6% of the FY 75 total consumption. Increment B projects save 53,199 MBtu/yr, or 13% of the FY 75 total consumption. Increment F projects save 104,107 MBtu/yr, or 25% of the FY 75 total consumption. Increment G projects save 17,029 MBtu/yr, or 4% of the FY 75 total consumption. The total savings for all projects is 199,836 MBtu/yr, or 48% of the total FY 75 consumption.

The effect of Increments A, B, G & F in terms of FY 84 dollars is as follows. Increment A projects will save $314,690 per year and willl cost $1,295,180. Increment B projects will save $318,220 per year and will cost $2,617,642. Increment F projects will save $1,205,887 per year and will cost $1,048,660. Increment G projects will save $126,020 per year and will cost $716,310. The projected cost of energy in 1984 is itemized in Table 3.3-1. Escalation rates and conversion factors are given in the Attachment to Table 3.3-1. The table and attachment can be found in Section 7.

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
F W8	Lower Domestic Hot Water Temperature	Barracks, Mess Halls, Family Housing	F	3,258.5	Immediate	1,230	4,008	41,498
F W15	Preventive Maintenance	All Buildings	F	-	Immediate	-	-	-
F W16	Temperature Control	Various Buildings	F	-	Immediate	-	2,135	6,753
F W17	Reduction of Space Heating Temperature	All Buildings, Except Dispensary	F	-	Immediate	-	19,619	206,388
F W18	Interior Lighting Control	Various Buildings	F	-	Immediate	-	-	-
F W19	Window Operation	All Buildings	F	-	Immediate	-	-	-
F W20	Door Operation	All Buildings	F	-	Immediate	-	-	-
F W21	Cooking Equipment Warm-up	Various Buildings	F	-	Immediate	-	-	-
F W23	Domestic Hot Water Circulating System	Various Buildings	F	-	Immediate	-	-	-
F W24	Resize Primary Heating Equipment	Various Buildings	F	-	Immediate	-	35,796	466,493
F W25	Energy Saving Ovens	Various Buildings	F	-	Immediate	-	-	-
F W26	Energy Saving Motors	Various Buildings	F	-	Immediate	-	-	-

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
F W30	Consolidate Partially Used Barracks	Barracks	F	-	Immediate	-	1,176	14,025
F W6	Use Cold Water Cleaning Chemical In Dishwashing Water	Mess Hall	F	2,013.5	0.1	740	1,490	7,559
F W7	Use Cold Water Detergent in Clothes Washing Machines	Barracks, Family Housing, Launderette	F	1,212.8	0.1	3,990	4,839	61,197
F W14	Change Burner Nozzles for Off-Peak Operation	Various Buildings	F	660.0	0.1	1,150	759	9,891
F W5	Install Flow Restrictors in Sink/Shower Head Water Faucets	Barracks, Family Housing and Administration	F	230.6	0.4	28,050	6,467	76,711
F W22	Upgrade Centratherm Control System	Various Buildings	F	115.4	0.7	48,120	5,551	70,661
OMA W12-1	Install Thermostatic Radiator Valves, Roof Insulation, Ceiling Fans for Heat Recovery	Gymnasium	G	63.9	2.9	36,010	2,300	12,280
OMA W9	Install Space Thermostat with Time Clock, Thermostatic Radiator Valves, Ceiling Fans for Heat Recovery, Weather Seal Windows & Doors, Install Storm Windows, Insulate Attic Floor	Theatre	G	56.7	3.1	23,550	1,335	7,550

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
ECIP WC1	Insulate Attic Floor, Weather Seal Windows & Doors, Install Thermostatic Radiator Valves	Various Buildings	A	38.7	2.1	111,900	4,332	54,190
OMA W15	Insulate Bare Pipes & Attic Floors, Install Thermostatic Radiator Valves	Exchange Service	G	37.7	4.9	24,590	927	5,020
OMA W5-1	Weather Seal Windows, Install Thermostatic Radiator Valves, Auto. O.A. Reset Control With Night Setback	Family Housing	G	37.4	4.9	74,600	2,790	15,120
F W1	Install Auto. Vent Damper Controls on Oil-Fired Boilers	Various Buildings	F	37.4	2.1	70,530	6,376	83,092
F W4	Install Waste Heat Recovery System for Refrigeration Equipment	W-700	F	34.8	4.5	14,590	508	3,239
OMA W10	Install Thermostatic Radiator Valves, Weather Seal Doors, Install Space Thermostat with Clock, Laundry Exhaust Heat Recovery	Exchange Service Outlet	G	32.4	3.3	14,280	462	4,290

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
OMA W13	Install Thermostatic Radiator Valves, Insulate Attic Floor, Auto. O.A. Reset Control with Night Setback	Post Chapel	G	30.6	6.0	14,370	440	2,390
F W11	Retrofit Interior Fluo. Ltg. with Low Energy Lamps & Ballasts	Various Buildings	F	30.2	3.8	411,140	12,433	108,242
OMA W19-1	Install Thermostatic Radiator Valves, Insulate Attic Floor	Open Mess NCO	G	29.3	5.7	60,210	1,766	10,590
OMA SL1	Install Street Lighting Control	Street Lighting	B	29.0	4.0	40,630	1,178	10,256
OMA W16-1	Auto O.A. Reset Control with Night Setback, Insulate Attic Floor, Install Thermosttic Radiator Valves, Install Storm Windows	Administration	G	24.4	7.6	76,220	1,857	10,060
OMA W7	Weather Seal Windows & doors, Install Storm Windows, Auto. O.A. Reset Control with Night Setback, Insulate Attic Floor, Thermostatic Radiator Valves	Dependent Grade School	G	24.1	4.3	60,460	1,459	14,070

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
OMA W16-2	Insulate Attic Floor, Install Thermostatic Radiator Valves	Administration	G	23.6	3.2	69,810	1,649	21,500
ECIP W5	Auto O.A. Reset Control with Night Setback, Install Strom Windows	Family Housing	A	22.5	8.2	100,000	2,254	12,210
ECIP W1	Weather Seal Doors, Insulate Attic Floor, Install Thermostatic Radiator Valves	Barracks	A	20.5	3.7	584,900	12,017	156,610
ECIP EMCS	Install Energy Management Control System	Various Buildings	B	20.2	1.3	2,577,012	52,021	307,964
OMA W5-2	Weather Seal Doors	Family Housing	G	16.2	4.7	8,630	140	1,820
ECIP W11	Insulate Attic Floor & Roof, Weaher Seal Doors, Ceiling Fans for Heat Recovery	Motor/Tank Repair Shop	A	13.9	5.4	394,620	5,483	73,240
ECIP W18	Insulate Attic Floor	General Storage Warehouse	A	13.6	5.6	103,760	1,415	18,440
OMA W19-2	Install Storm Windows	Open Mess NCO	G	13.5	13.7	24,600	332	1,800
OMA W20-2	Install Storm Windows	Fire Station	G	11.0	7.0	3,880	43	560
F W9	Install a Partition with Door to Isolate an Unoccupied Space	W-12	F	10.9	17.0	8,180	89	482

TABLE 10-1

INCREMENTS A, B, F, AND G PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	INCREMENT	E/C RATIO	PAYBACK PERIOD	FY84 CWE $	ANNUAL SAVINGS ENERGY (MBTU)	ANNUAL SAVINGS FY84 (DOLLARS)
F W2	Install Vehicle Exhaust System	W-228, 400 and 607	F	9.9	9.2	36,900	367	4,007
OMA W11-2	Install Storm Windows	Motor/Tank Repair Shop	G	8.7	8.8	91,680	798	10,390
F W3	Improve Kitchen Hood Exhaust System	Various Buildings	F	8.5	11.0	290,100	2,460	26,466
OMA W12-2	Retrofit Existing Mercury Vapor Lamps to High Pressure Sodium Lamps	Gymnasium	G	6.5	17.7	33,900	220	1,920
OMA W21-2	Insulate the Walls	Dispensary	G	5.1	15.0	99,520	511	6,660
F W10	Replace Damaged Roll-Up Door with Insulated Type	W-400	F	4.9	15.8	6,980	34	443
F W12	Install Power Factor Control	W-400	F	-	0.7	1,800	-	2,590
F W13	Install Time Clock Controls on Laundry Equipment for Night Tariff Operation	Barracks, Family Housing	F	-	1.6	25,160	-	16,150
		Subtotals	A = 5 Projects			1,295,180	25,501	314,690
			B = 2 Projects			2,617,642	53,199	318,220
			F = 27 Projects			1,048,660	104,107	1,205,887
			G = 16 Projects			716,310	17,029	126,020
		Totals	50 Projects			5,677,792	199,836	1,964,817

1.5.2 PROJECTED CONSUMPTION

Table 1.5 shows the known FY 75 total energy consumption. The projected energy consumption after energy conservation projects is identified in the table under the column heading, 1985 MBTU (PROJECTED). It assumes that all the projects in Table 10-1 are completed by 1985. This projected energy consumption is the known FY 75 consumption times (1 - % reduction). It is the amount of energy that the buildings we studied will consume in 1985 after the energy conservation projects have been implemented.

The known consumption and the projected consumption are also given on a square foot basis. The quantity under the column heading, 1975 KBTU/SF (KNOWN), uses the 1975 gross floor area, from Table 3.2-1 and the quantity under the column heading, 1985 KBTU/SF (PROJECTED) uses the 1985 gross floor area.

New construction is accounted for in Table 1.5 under the column heading, 1987 MBTU FUTURE CONSTRUCTION; an estimate for the energy that will be consumed by Wildflecken in 1987 is obtained by adding the expected energy consumption of new construction (based on Design Energy Budgets which are based on AR 415-28) to the 1985 MBTU (PROJECTED). A detailed teatment of futute energy use resulting from facilities changes can be found in Section 4.7.

1.5.3 GOALS

The goal of the U. S. Army is a 20% reduction of energy consumption for building area constructed before FY 78. The goals have been calculated for the Vilseck ATC and presented in Table 3.2-1. A copy of which is included hereafter.

Table 1.5 presents the projected consumption for Wildflecken. It will be compared to Table 3.2-1 and it will be shown that the goals are met. From line 3 of Table 3.2-1 a FY 85 consumption of 346,987 MBtu has been set for Building Area In Use Constructed Before FY 78. This is the building area that was studied for the Energy Report. From Table 1.5, the FY 85 consumption will be 213,406 MBtu if all of the recommendations in Table 10-1 have been implemented by that time. The goal is met by a margin of 133,581 MBtu. The consumption goals on a square foot basis are met by a correspondingly large margin. The goal is 122 kBtu/sf in FY 85. From Table 1.5, the projected 1985 consumption is 78 kBtu/sf, a margin of 47 kBtu/sf.

WILDFLECKEN SUBCOMMUNITY

TABLE 1.5

PROJECTED TOTAL ENERGY CONSUMPTION MBTU/YEAR						
1975 KBTU/SF (KNOWN)	1975 MBTU (KNOWN)	% REDUCTION	1985 KBTU /SF (PROJECTED)	1985 MBTU (PROJECTED)	% INCREASE FUTURE CONST.	1987 MBTU FUTURE CONST.
153	410,398	48	75	213,406	9.1	232,825

TABLE 3.2-1 ENERGY CONSUMPTION: PROGRESS AND GOALS FOR FY 85: WILDFLECKEN

		UNITS	FY75	FY80	FY85
1a.	Electricity	MBTU	101,432	136,565	
b.	Coal	MBTU	114,442	102,960	37,104 Goal (10%)
c.	Fuel Oil # 2	MBTU	194,524	202,836	
d.	Fuel Oil # 6	MBTU	-	-	
e.	Solar Energy	MBTU	-	-	3,712 Goal (1%)
f.	Total Energy	MBTU	410,398	442,361	-
2a.	Goal: Total Energy Reduced 25%: (0.75 x $1f_{FY75}$)	MBTU	-	-	307,799
b.	Goal: Energy Per Sq. Ft. Reduced 20% by ECIPS and Mgmt, and 5% by New Efficient Bldgs (3a x 3c) + (4a x 4b)	MBTU	-	-	371,045
3a.	Building Area in use, constructed before FY 78	SQ.FT.	2,680,573	2,876,158	2,844,158
b.	Energy Per Sq. Ft. (1f ÷ 3a)	KBTU/SQ. FT.	153	-	-
c.	Goal: Energy Per Sq. Ft. Reduced 20% by ECIPS (12%), and Mgmt (8%): (0.8 x $3b_{FY75}$)	KBTU/SQ. FT.	-	-	122
d.	Total Energy	MBTU	410,398	-	346,987
4a.	Building Area in use, constructed after FY 78	SQ.FT.	-	185,081	286,406
b.	Goal: Energy Per Sq. Ft. Reduced 45% by Efficient Design (0.55 x $3b_{FY75}$)	KBTU/SQ. FT.	-		84
c.	Total Energy	MBTU	-		24,058
5a.	Gross Floor Area (3a + 4a)	SQ.FT.	2,680,573	3,061,239	3,130,564
b.	Energy Per Sq. Ft (1f ÷ 5a)	KBTU/SQ. FT.	153	144	-
c.	Goal: 25% Reduction (0.75 x $5b_{FY75}$)	KBTU/SQ. FT.	-	-	114
d.	Goal: Army Facilities Energy Plan, Annex B-5	KBTU/SQ. FT.	-	-	135
6a.	Heating Degree Days	DEG F - DAYS		7,693	
7A.	Population		4,850	6,578	7,050

When accounting for future construction and demolition, the goal for FY 85 is 371,045 MBtu. The estimate of future consumption, taking into account new construction, is 232,825 MBtu in FY 87. (Refer to Table 1.5). The goal is met by 138,220 MBtu/yr. This figure is conservative because the additional construction between 1985 and 1987 increases the estimated consumption.

2. INCREMENTS A AND G

2.1 REQUIREMENTS

Increment A deals with energy conservation investigations for buildings and processes. It deals with the investigation of ECIP projects which involve modifying, improving or retrofitting existing buildings, (including family housing), to include architectural and structural features, HVAC systems, plumbing systems, interior or exterior building and parking facilities lighting.

Increment G deals with projects developed in Increment A which result in energy savings but do not qualify under ECIP criteria.

A list of Energy Conservation Opportunities (ECO's) that we investigated is presented in Table 2.1.

2.2 SUMMARY OF RESULTS

For a project to qualify as an FY 84 ECIP project, it must have an E/C > 13, B/C > 1, and a Project Cost > $100,000. In Table 6.1, Interim Submittal we have summarized all feasible ECIP projects. A copy is included hereafter.

Energy conservation projects with E/C < 13 or Project Cost < $100,000 which cannot qualify as FY 84 ECIP projects, but which we feel are suitable for implementation from non-ECIP funding sources such as OMA or MMCA Programs, have also been included in Table 6.1 as OMA projects.

As indicated in Table 6.1, we have recommended 5 ECIP Projects and 16 OMA Projects for implementation.

The original Interim Submittal version of Table 6.1 listed the projects by building type. As a result of a suggestion by the Subcommunity, to consider the combining of smaller OMA projects, the present version of Table 6.1 groups projects by type (ECIP or OMA) and within each group lists projects by E/C ratio, highest to lowest.

The combining of projects eliminates the consideration of projects by building type. What is gained is an additional ECIP project. A copy of revised Table 6.1 is used in this volume.

Table 2.1

LEGEND: PROPOSED ECOS

1.....ATTIC FLOOR INSULATION
2.....ROOF INSULATION
3.....WALL INSULATION
4.....INSTALL STORM WINDOWS
5.....WEATHER SEAL GARAGE DOORS
6.....WEATHER SEAL ENTRANCE DOORS
7.....INSTALL RADIATOR ATC VALVE
8.....INSTALL O.A. RESET SYSTEM
9.....INSTALL NIGHT SETBACK
10....CONVERT STEAM TO H.W. HEATING
11....CONVERT TO CENTRAL BOILER
12....INSTALL PIPE INSULATION
13....INSTALL NEW BOILER(S)
14....REPL INCANDESCENT LIGHTING WITH HIGH PRESSURE SODIUM
15....REPL HANDFIRED W/AUTOFIRED BOILER
16....REPL H.W. STORAGE TANK
17....WEATHER SEAL WINDOWS
18....INSTALL CEILING FAN FOR HEAT RECOVERY
19....INSTALL SPACE THERMOSTAT
20....INSTALL FAN ON/OFF CONTROL
21....CONVERT FROM MANUAL OA HW RESET TO AUTOMATIC
22....INSTALL HEATING ON/OFF CONTROL
23....INSTALL NIGHT SETBACK WITH OA HW RESET
24....INSTALL MULTIPLE ZONE CONTROL

TABLE 6.1

ECIP/OMA PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

BUILDING TYPE NO.	BUILDING TITLE	PROJECT TYPE	E/C RATIO	B/C RATIO	FY84 CWE (DOLLARS)	ANNUAL ENERGY SAVINGS				FY84 COST SAVINGS (DOLLARS)
						NO. 2 OIL MBTU	COAL MBTU	ELECT. MBTU	TOTAL MBTU	
-	Combined ECIP	ECIP WC1	38.7	6.0	111,900	4,034	298	-	4,332	54,190
5	Family Housing	ECIP W5	22.5	1.3	100,000	-	2,254	-	2,254	12,210
1	Barracks	ECIP W1	20.5	2.3	584,900	12,017	-	-	12,017	156,610
11	Motor/Tank Repair Shop	ECIP W11	13.9	1.6	394,620	5,897	-	(-)414	5,483	73,240
18	General Storage Warehouse	ECIP W18	13.6	3.4	103,760	1,415	-	-	1,415	16,440
12	Gymnasium	OMA W12-1	63.9	3.5	36,010	-	2,358	(-)58	2,300	12,280
9	Theatre	OMA W9	56.7	2.5	23,550	-	1,239	96	1,335	7,550
15	Exchange Service	OMA W15	37.7	2.1	24,590	-	927	-	927	5,020
5	Family Housing	OMA W5-1	37.4	1.5	74,600	-	2,790	-	2,790	15,120
10	Exchange Service Outlet	OMA W10	32.4	2.5	14,280	274	280	(-)92	462	4,290
13	Post Chapel	OMA W13	30.6	1.7	14,370	-	440	-	440	2,390
19	Open Mess NCO	OMA W19-1	29.3	1.9	60,210	133	1,633	-	1,766	10,590

TABLE 6.1

ECIP/OMA PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

BUILDING TYPE NO.	BUILDING TITLE	PROJECT TYPE	E/C RATIO	B/C RATIO	FY84 CWE $	ANNUAL ENERGY SAVINGS NO. 2 OIL MBTU	COAL MBTU	ELECT. MBTU	TOTAL MBTU	FY84 COST SAVINGS $
16	Administration	OMA W16-1	24.4	1.4	76,220	-	1,857	-	1,857	10,060
7	Dependent Grade School	OMA W7	24.1	2.0	60,460	809	650	-	1,459	14,070
16	Office Building	OMA W16-2	23.6	3.9	69,810	1,649	-	-	1,649	21,500
5	Family Housing	OMA W5-2	16.2	1.8	8,630	140	-	-	140	1,820
19	Open Mess NCO	OMA W19-2	13.5	1.0	24,600	-	332	-	332	1,800
20	Fire Station	OMA W20-2	11.0	2.8	3,880	43	-	-	43	560
11	Motor/Tank Repair Shop	OMA W11-2	8.7	2.2	91,680	798	-	-	798	10,390
12	Gymnasium	OMA W12-2	6.5	1.0	33,900	-	-	220	220	1,920
21	Dispensary	OMA W21-2	5.1	1.3	99,520	511	-	-	511	6,660
	Subtotal	ECIP = 5			1,295,180	23,363	2,552	(-)414	25,501	314,690
		OMA = 16			716,310	4,357	12,506	166	17,029	126,020
Totals	21 Projects				2,011,490	27,720	15,058	(-)248	42,530	440,710

TABLE 6.1A

SUMMARY OF PROJECT ECOs

WILDFLECKEN SUBCOMMUNITY

BUILDING TYPE NO.	BUILDING TITLE	PROJECT TYPE	ATTIC FLOOR INSULATION	ROOF INSULATION	WALL INSULATION	INSTALL STORM WINDOWS	WEATHER SEAL GARAGE DOORS	WEATHER SEAL ENTRANCE DOORS	INSTALL RADIATOR ATC VALVE	INSTALL O.A. RESET SYSTEM	INSTALL NIGHT SETBACK	CONVERT STEAM TO H.W. HEATING	CONVERT TO CENTRAL BOILER	INSTALL PIPE INSULATION	INSTALL NEW BOILER(S)	REPL. MERCURY VAPOR TO HIGH PRES. SODIUM	REPL. HANDFIRED W/AUTOFIRED BOILER	REPL. H.W. STORAGE TANK	WEATHER SEAL WINDOWS	INSTALL CEILING FAN FOR HEAT RECOVERY	INSTALL SPACE THERMOSTAT	INSTALL FAN ON/OFF CONTROL	CONVERT FROM MANUAL OA HW RESET TO AUTOMATIC	INSTALL HEATING ON/OFF CONTROL	INSTALL NIGHT SETBACK WITH OA HW RESET	INSTALL MULTIPLE ZONE CONTROL			
-	Combined ECIP	ECIP WC1	•				•	•	•										•											
5	Family Housing	ECIP W5				•																				•				
1	Barracks	ECIP W1	•					•	•																					
11	Motor/Tank Repair Shop	ECIP W11	•	•			•													•										
18	General Storage Warehouse	ECIP W18	•																											
12	Gymnasium	OMA W12-1		•					•											•										
9	Theatre	OMA W9	•			•		•	•										•	•	•									
15	Exchange Service	OMA W15	•						•					•																
5	Family Housing	OMA W5-1							•										•							•				
10	Exchange Service Outlet	OMA W10						•	•												•						•			

TABLE 6.1A

SUMMARY OF PROJECT ECOs

WILDFLECKEN SUBCOMMUNITY

BUILDING TYPE NO.	BUILDING TITLE	PROJECT TYPE	ATTIC FLOOR INSULATION	ROOF INSULATION	WALL INSULATION	INSTALL STORM WINDOWS	WEATHER SEAL GARAGE DOORS	WEATHER SEAL ENTRANCE DOORS	INSTALL RADIATOR ATC VALVE	INSTALL O.A. RESET SYSTEM	INSTALL NIGHT SETBACK	CONVERT STEAM TO H.W. HEATING	CONVERT TO CENTRAL BOILER	INSTALL PIPE INSULATION	INSTALL NEW BOILER(S)	REPL. MERCURY VAPOR TO HIGH PRES. SODIUM	REPL. HANDFIRED W/AUTOFIRED BOILER	REPL. H.W. STORAGE TANK	WEATHER SEAL WINDOWS	INSTALL CEILING FAN FOR HEAT RECOVERY	INSTALL SPACE THERMOSTAT	INSTALL FAN ON/OFF CONTROL	CONVERT FROM MANUAL OA HW RESET TO AUTOMATIC	INSTALL HEATING ON/OFF CONTROL	INSTALL NIGHT SETBACK WITH OA HW RESET	INSTALL MULTIPLE ZONE CONTROL			
13	Post Chapel	OMA W13	•						•																	•				
19	Open Mess NCO	OMA W19-1	•						•																					
16	Office Buildings	OMA W16-1	•			•			•																	•				
7	Dependent Grade School	OMA W7	•			•		•	•										•							•				
16	Office Building	OMA W16-2	•						•																					
5	Family Housing	OMA W5-2						•																						
19	Open Mess NCO	OMA W19-2				•																								
20	Fire Station	OMA W20-2				•																								
11	Motor/Tank Repair Shop	OMA W11-2				•																								
12	Gymnasium	OMA W12-2														•														
21	Dispensary	OMA W21-2			•																									

A new summary, Table 6.1A, Interim Submittal was created to indicate the types of ECOs included in each project. A copy of Table 6.1A is included hereafter.

If all these projects are implemented at a CWE FY 84 of $2,011,490, the subcommunity will save 42,530 MBtu of energy, which is approximately 10% of its total energy consumption. The annual dollar savings will be $440,710.

2.3 PROGRAM DOCUMENTS

A complete set of Program Documents, DD Form 1391s and PDB-1s, plus attachments, for each ECIP and OMA project are included in the Interim Submittal, Volume 5, Books 1 and 2.

3. INCREMENT B

3.1 REQUIREMENTS

Increment B requires the following:

a. Study the existing utilities and energy distribution systems, and existing energy plants; identify and analyze possible energy conservation projects.

b. Determine the feasibility of an EMCS for building electrical, and mechanical systems and utility distribution.

c. Develop a load profile for the past three years indicating the quantities of each energy source procured (heating oil, coal, electricity, etc.); and the peak demand loads, and essential loads.

d. Develop graphic presentation of hourly KW demand for peak load/demand days. Develop procedures to reduce peak demand by load shedding.

e. Project energy costs three years from the date of Contract award, and estimate the heating, lighting and other costs per square foot per year.

3.2 SUMMARY OF RESULTS

Our investigation of potential Increment B projects resulted in two recommendations: a Street Lighting OMA project and an EMCS ECIP project. The combined energy savings amounts to 52,021 MBtu/yr with an equivalent dollar savings of $428,701/yr. This represents a 11.8% reduction of FY 80 basewide energy consumption.

The major savings come from the EMCS recommendation. The Street Lighting project is documented in the Prefinal Submittal, Volume 5, OMA SL1. The EMCS is described in Volume 8 of this Pre-Final Submittal. A summary of the EMCS study is presented in Section 3.1 of this narrative.

The Interim Submittal describes our investigation of Increment B projects, excluding the EMCS study, and is summarized as follows:

a. We have obtained information on and studied in significant detail the subcommunities electrical system, street lighting system, potable water system, sewage collection and treatment system, hot water and steam distribution system; as well as existing energy plants consisting of Central Boiler Plants and Local-Building Boiler Plants.

b. We have recommended several projects that require the modification of boiler plant controls such as installation of OA HW reset control, night set-back control and installation of time-clock. These projects however, have been presented under Increments A or G.

c. We have developed electricity and fuel consumption load profiles for the past three years and presented them in Section 3 of the Interim Submittal.

d. Graphical profiles of hourly kw demand occuring on a weekday, weekend and peak demand day have been developed, presented and discussed in Paragrpah 7.2.4 of the Interim Submittal, for each month of FY 80. We have discussed existing peak demand limiting systems, and will investigate if the EMCS is feasible for further demand limiting.

e. Based on the AXCESS analysis of each building type, we have estimated the annual energy consumption and cost per square foot of each building type for Electricity, Fuel, Space Heating, Domestic Hot Water, Lighting and Miscellaneous Equipment. We have also projected these FY 80 to FY 84. Tabulated cost data has been presented in Section 5 of the Interim Submittal.

3.3 INCREMENT B - EMCS FEASIBILITY STUDY

3.3.1 PURPOSE

The purpose of this study is to determine the technical and economic feasibility of utilizing Energy Monitoring and Control system (EMCS) techniques at the Wildflecken Subcommunity, Wildflecken, West Germany.

This effort is to develop a systematic plan to reduce energy consumption in compliance with the objectives put forth in the Army Facilities Energy Plan. Within the scope of this study, recommendations for the possible implementation of those objectives will be investigated.

3.3.2 PARAMETERS OF THE FEASIBILITY STUDY

Of the 184 buildings in the subcommunity, 156 are considered. Inclusion is based on engineering judgment for potential economic payback.

3.3.3 SCOPE OF WORK

a. Supplement the site investigation with "as built" drawings, as well as sound engineering judgment.

b. Interview administrative personnel to determine operating hours and procedures relative to the surveyed buildings.

c. Identity EMCS energy conserving programs and strategies which might be appropriate for each of the buildings, listing the points required.

d. Evaluate by computer analysis, energy conserved by these programs as well as their implementation costs in accordance with Energy Conservation Investment Program (ECIP) requirements.

e. Make recommendations which may include in the EMCS some systems, points and/or programs which, while not directly related to energy savings, would provide management information and centralized control, making for more efficient facility operation.

3.3.4 SUMMARY

It was determined that 142 of the buildings in the Wildflecken Subcommunity are technically feasible while meeting the ECIP guidelines for EMCS installation. Total cost estimate for implementation is $2,657,424.

The estimated energy savings with the recommended EMCS are 2,852 MBtu of electricity (lighting) and 49,169 MBtu of heating fuel. This represents a 11% reduction of FY 80 basewide energy consumption.

ECIP Summary

CWE	$ 2,577,012
Design Cost	$ 80,412
Total	$ 2,657,424

Total Benefits	$ 3,428,246
Discounted Benefit/Cost Ratio (>1)	1.3
Total Annual Energy Savings	52,021 MBtu
E/C Ratio	20
Annual $ Savings	$ 307,964
Payback Period	8.4 yr

The proposed new EMCS equipment is to be designed to meet the requirements of the Inter-Agency Guide Specification, a document developed to standardize government procurement of strategies for centralized computer control for energy conservation. To meet this objective a small sized EMCS, according to Specification CEGS-13949, is recommended.

Buildings not recommended either did not meet initial criteria or were determined to be an ineffective application upon physical inspection.

3.3.5 EXCLUDED FROM SCOPE OF INVESTIGATION

The scope of the analysis and site investigation is limited only to those considerations which impact on energy. Excluded from consideration are all process, manufacturing or laboratory equipment and systems, as well as fire alarms and security.

3.3.6 CONCLUSIONS

In analyzing the 142 applicable buildings in the Wildflecken Subcommunity, the installation reflects a total Benefit/Cost ratio of 1, an Energy/Cost ratio of 20 and payback period of 8.4 years.

Results are in accordance with ECIP B/C >1 and E/C >13 prerequisites for ECO implementation and payback period of less than 15 years.

Strategies in order of cost effectiveness:

a. Reducing fuel consumption during the heating season by means of temperature setback during unoccupied hours.

b. Optimized control of boilers.

c. Lighting reduction/shutdown during unoccupied periods.

3.3.7 RECOMMENDATIONS

a. Implement the installation of an Energy Monitoring and Control System in the Wildflecken Subcommunity, Wildflecken, West Germany.

b. The system will consist of one control room to accommodate the facility.

c. Install the EMCS at the estimated construction cost of $2,657,424.

d. Provide a system configuration, programs, and strategies as described in this study.

e. Note that possible further savings can be realized by the use of EMCS to provide remote controlled space temperatures during normal occupancy periods. Additional savings may be achieved when the EMCS is used to its full potential to provide management reports and maintenance information. These have not been included in the ECIP calculations since they imply future changes in operating procedures which may not be realized.

4. INCREMENT F

4.1 OBJECTIVES

The objectives of Increment F are summarized as follows:

a. To recommend modifications and changes in system operation which are within the Facilities Engineer funding authority and management control. Recommendations shall be in the form of specific, practical instructions for the use of Facilities Engineer personnel.

b. To summarize and establish the priority of all energy conservation measures and projects from Increments A, B, F and G for use of the Community Commander and Facilities Engineer in developing their energy management plans.

The Scope of Work (Schedule of Title Services Rev) is included in Appendix 1-A, Volume 7 of the Prefinal Submittal.

4.2 MODIFICATIONS INVESTIGATED

A total of 30 potential modifications were investigated from which we developed twenty-seven recommendation for Building and Maintenance/Operations systems.

Fourteen of the twenty-seven recommendations relate to Building Equipment Systems and are based on an analysis of building field survey data.

Ten recommendations relate to the Maintenance and Operation (M/O) procedures in use by the Facilities Engineer Division of the Wildflecken Subcommunity. The analysis of existing M/O procedures is based on field data consisting of answers to questions put to the Facilities Engineer and members of his staff.

4.2.2 Two investigations were developed into recommendations concerning expendable equipment.

4.2.3 Three investigations developed into non-recommendations.

4.2.4 One investigation did not fall under the Facilities Engineer management control but because it has an easily understandable effect on energy conservation, we have included it as a miscellaneous recommendation.

4.3 SUMMARY

The projects investigated are listed, as follows:

4.3.1 MODIFICATIONS TO BUILDING SYSTEMS

S&H PROJECT NO.	DESCRIPTION
F W1	Install Automatic-Vent Damper Controls On Oil-Fired Boilers.
F W2	Install Vehicle Exhaust System.
F W3	Improve Kitchen Hood Exhaust System.
F W4	Install Waste Heat Recovery for Refrigeration Equipment.
F W5	Install Flow Restrictors in Sink and Shower Supply Pipes.
F W6	Use Cold Water Cleaning Chemical in Dishwasher Wash Cycle.
F W7	Use Cold Water Detergent For Washing Clothes.
F W8	Lower Domestic Hot Water Temperature.
F W9	Install a Partition Door to Isolate an Unoccupied Space.
F W10	Replace Damaged Roll-Up Doors with Insulated Type.
F W11	Retrofit Interior Fluorescent Lighting With Low Energy Lamps and Ballasts.
F W12	Install Power Factor Control.
F W13	Install Time Clock Control on Laundry Equipment to Allow Only Night Tariff Operation.
F W14	Change Burner Nozzles for Off-Peak Operation.

4.3.2 MODIFICATIONS TO MAINTENANCE/OPERATIONS SYSTEMS

F W15 Preventive Maintenance Program.

F W16 Temperature Control Technician.

F W17 Reduction of Space Heating Temperatures.

F W18 Interior Lighting Control.

F W19 Window Operation.

F W20 Door Operation.

F W21 Cooking Equipment Warmup.

F W22 Upgrade Centratherm Control System.

F W23 Steam Trap Replacement.

F W24 DHW Circulating System.

F W24 Resize Primary Heating Equipment.

4.3.3 EXPENDABLE EQUIPMENT

F W25 Energy Saving Ovens.

F W26 Energy Saving Motors.

4.3.4 PROJECTS NOT RECOMMENDED

F W27 Installation of Low Energy Fluorescent Lamps and Ballasts to Replace Burned-Out Interior Lighting.

F W28 Install Flow Restrictors in Faucet Spouts and Shower Heads.

F W29 Use Warm Water Detergent in Dishwasher Wash Cycle.

The above projects are not recommended becasue they are alternative approaches to ECO's that are recommended. For a detailed analysis see the Energy Report, Final Submittal, Volume 2, Section 8.11.1. The recommended projects for alternative F W27, F W28 and F W29 are respectively F W11 "Retrofit Existing Interior Fluorescent Lighting With Low Energy Lamps and Ballasts", F W5 "Install Flow Restrictors In Sink and Shower Supply Pipes", F W6 "Use Cold Water Cleaning Chemical in Dishwasher Wash Cycle". The recommended

project for F W11 and F W6 have higher E/C ratios than their alternatives. But, F W5 is chosen over its alternative, F W28" Install Flow Restrictors in Faucet Spouts and Shower Heads" because of a technical consideration. The restrictor orifices for faucets and showers are small and will clog quickly will depsoits due to the high mineral content of the water at Wildflecken.

4.3.5 MODIFICATION NOT UNDER FE MANAGEMENT CONTROL

F W30 Consolidate Partially Used Barracks.

4.4 INVESTIGATION CONCLUSIONS

The effects, in energy and cost savings, of implementing the above listed modifications are summarized in Table 2-1 of Volume 6 of the Prefinal Submittal, a copy of which is included hereafter.

4.4.1 BUILDING SYSTEMS

Building systems modifications would result in annual energy savings of 39,830 MBtu/yr. and equivalent annual dollars savings of $441,547/yr (FY 84 escalated). This represents a 9% reduction of FY 80 basewide energy consumption. Implementation costs would amount to $1,000,540. The overall payback period is 2.27 years.

4.4.2 MAINTENANCE/OPERATIONS SYSTEMS

Of the ten M/O systems modifications four have calculable energy and cost savings, and the remaining six are recommendations without calculable savings.

The five modifications having calculated savings (F W16, F W17, F W22, F W24), if implemented, would yield a total annual energy savings of 63,101 MBtu/yr and equivalent annual dollar savings of $750,315/yr. This represents a 14% reduction in FY 80 basewide energy consumption.

The energy and cost savings for the six recommendations without calculable savings (F W15, F W18, F W19, F W20, F W21, F W23), are not easily defined. Exact factual data such as hours of occurrence (e.g. how many hours are lights left on in unoccupied spaces or rolling doors left open) could not be determined during a three week survey period. Therefore, these recommendations are general in nature and are made because of their obvious energy savings result.

TABLE 2-1

INCREMENT F PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	E/C RATIO	PAYBACK PERIOD (YEARS)	IMPLEMENTATION COST		ANNUAL SAVINGS	
					CWE FY84 (DOLLARS)	FE (MAN HOURS)	ENERGY (MBTU)	FY84 (DOLLARS)
F W8	Lower Domestic Hot Water Temperatre	Barracks, Mess Hall, Family Housing	3,258.5	Immediate	1,230	79	4,008	41,498
F W15	Preventive Maintenance	All Buildings	-	Immediate	-	-	-	-
F W16	Temperature Control	Various Buildings Technician	-	Immediate	-	2,080	2,135	6,755
F W17	Reduction Of Space Heating Temperature	All Types Except Type 21 Dispensary	-	Immediate	-	-	19,619	206,388
F W18	Interior Lighting Control	Various Buildings	-	Immediate	-	-	-	-
F W19	Window Operation	All Buildings	-	Immediate	-	-	-	-
F W20	Door Operation	All Buildings	-	Immediate	-	-	-	-
F W21	Cooking Equipment Warm-Up	Various Buildings	-	Immediate	-	-	-	-
F W23	Domestic Hot Water Circulating System	Various Buildings	-	Immediate	-	-	-	-
F W24	Resize Primary Heating Equipment	Various Buildings	-	Immediate	-	-	35,796	466,493

TABLE 2-1

INCREMENT F PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	E/C RATIO	PAYBACK PERIOD (YEARS)	IMPLEMENTATION COST		ANNUAL SAVINGS	
					CWE FY84 (DOLLARS)	FE (MAN HOURS)	ENERGY (MBTU)	FY84 (DOLLARS)
F W25	Energy Saving Ovens	Various Buildings	-	Immediate	-	-	-	-
F W26	Energy Saving Motors	Various Buildings	-	Immediate	-	-	-	-
F W30	Consolidate Partially Used Barracks	Barracks	-	Immediate	-	-	1,176	14,025
F W6	Use Cold Water Cleaning Chemical In Dishwasher Wash	Mess Hall	2,013.5	0.1	740	34	1,490	7,539
F W7	Use Cold Water Detergent In Clothes Washing Machines	Barracks, Family Housing, Launderette	1,212.8	0.1	3,990	127	4,839	61,197
F W14	Change Burner Nozzles For Off-Peak Operation	Various Building	660.0	0.1	1,150	146	759	9,691
F W5	Install Flow Restrictors In Sink/Shower Head Supply Pipes	Barracks, Family Housing and Administration	230.6	0.4	28,050	747	6,467	76,711
F W22	Upgrade Centratherm Control System	Various Buildings	115.4	0.7	48,120	-	5,551	70,681
F W1	Install Automatic Vent Damper Controls on Oil-Fired Boilers	Various Buildings	37.4	2.1	170,530	-	6,376	83,092
F W4	Install Waste Heat Recovery System For Refrig. Equipment	W-700	34.8	4.5	14,590	-	506	3,239

TABLE 2-1

INCREMENT F PROJECT SUMMARY
WILDFLECKEN SUBCOMMUNITY

PROJECT ID	MODIFICATION	APPLICABLE BUILDINGS	E/C RATIO	PAYBACK PERIOD (YEARS)	IMPLEMENTATION COST		ANNUAL SAVINGS	
					CWE FY84 (DOLLARS)	FE (MAN HOURS)	ENERGY (MBTU)	FY84 (DOLLARS)
F W11	Retrofit Interior Fluo. Ltg. w/Low Energy Lamps & Ballasts	Various Buildings	30.2	3.8	411,140	5,520	12,433	108,242
F W9	Install A Partition Door To Isolate An Unoccupied Space	W-12	10.9	17.0	8,180	-	89	462
F W2	Install Vehicle Exhaust Systems	W-228, 400 and 607	9.9	9.2	36,900	-	367	4,007
F W3	Improve Kitchen Hood Exhaust System	W-210, 220, 230 252, 260 and 280	8.5	11.0	290,100	-	2,460	26,466
F W10	Replace Damaged Roll-Up Door With Insulated Type	W-400	4.9	15.8	6,980	-	34	445
F W12	Install Power Factor Control	W-400	-	0.7	1,800	16	-	2,590
F W13	Install Time Clock Controls On Laundry Equipment For Night Tariff Operation	Family Housing, Barrack Buildings	-	1.6	25,160	912	-	16,150
Totals	27 Projects			0.9	1,048,660	9,661	104,107	1,205,867

Of the four modifications with calculable savings, F W17 is a no-cost implementation, F W22 has calculable implementation cost, and F W24, has no calculable implementation cost. Therefore, an overall payback period cannot be calculated for these three recommendations.

The recommendation for a Temperature Control Technician (F W16) was based on an analysis of a single type of inoperative control condition. Therefore, since more types of inoperative controls are normally encountered, the calculated energy savings are minimal. The uncertainty of the type and amount of inoperative controls that could develop from year to year make it impossible to calculate exact savings.

4.4.3 EXPENDABLE EQUIPMENT

The energy savings for expendable equipment (F W25, F W26) are caluclated for a single piece of equipment since no one can predict how many pieces of equipment will fail at a given time. Implementation costs are also on a piece basis and are incremental costs since this is a replacement recommendation, not a retrofit.

4.4.4 MISCELLANEOUS

A practical approach to energy conservation requiring no equipment changes is suggested by the recommendation Consolidate Partially Used Barracks (F W30). This recommendation can produce considerable savings at practically no cost and for these reasons is included in our list of recommendations. Our analysis of four buildings indicates a potential annual energy savings of 1,176 MBtu/yr and an equivalent annual dollar savings of $11,335/yr (FY 84 escalated).

4.5 ENERGY CONSERVATION MODIFICATIONS SINCE 1975

A complete listing of energy conservation related projects is given in Section 9 of Volume 6 of the Prefinal Submittal. The listing was updated in April 1982 and is current as of this date.

Many of the projects were not established as specific energy conservation projects. They were the result of normal repair projects that incorporated energy saving features. Therefore they qualified as energy conservation modifications.

The list contains two ECIP projects and fifty seven OMA projects.

4.5.1 GENERAL

A meeting was held with the Chief of Engineering Plans and Services to discuss energy conservation modifications at the Wildflecken Subcommunity since 1975. A review of records uncovered no projects other than those already listed in Section 2.3.1 of Volume Interim Submittal.

4.5.2 PROJECT LISTING

The list of previous energy related projects is again presented, for easy reference:

ECIP PROJECTS

7T-173-80	Attic insulation/installation of thermostatic radiator valves in FH Facilities, 7ATC. Received 1391 Form, from Grafenwoehr.
7T-947-81	Central Heating Plant. Received FE work request.

OMA PROJECTS

7T-875-75	Replace hand-fired boiler with auto coal boiler, Building No. 36. Received job order request.
7T-950a-76	Replace windows, Buildings No. 7, 131, 133, 140 through 146. Received job order request.
7T-845-77	Convert heating system, Buildings No. 600 through 619.
7T-854-77	Replace hand-fired boiler with automatic coal boiler, Building No. 12. Received job order request.
7T-831-77	Modernization of electrical high and low tension distribution system. Received job order request.
7T-856-77	Replace hand-fired boiler with automatic coal fired boiler, Buildings No. 700, 16. Received job order request.

7T-857-77*	Exchange Boiler, Building No. 8.
7T-915-78*	Exchange coal fire boiler, Building No. 711.
7T-826-79	Convert LP steam to warm water heating, Buildings No. 2, 29, 32, 33. Received job order request.
7T-846-79	Replace hand-fired boiler with automatic coal boiler, Building No. 371. Received job order request.
7T-874-79*	Convert Air Heating system to WW heating system, Building No. 500. Received job order request.
7T-889-79	Convert LP steam to warm water heating, Building No. 4. Received job order request.
7T-975-79	Replace window, exterior weathersealing, Buildings No. 82 through 87.
7T-837-80	Convert steam to HW, Building No. 620.
7T-859-80	Add insulation to exterior walls, Buildings No. 40 through 43. Received job order request.
7T-904-80*	Convert LP steam to warm water heating, Building No. 11. Received job order request.
7T-947-81*	New central heating plant. Received job order request.
7T-953-80*	Exchange 6 ea. coal fuel boiler, Buildings No. 82 through 87.
7T-0868-81*	Insulate ceiling, Buildings No. 604 and 605.
7T-0924-81*	Replace LP steam boiler, Building No. 607. Received job order request.
7T-0927-81*	Convert steam heating system, Buildings No. 210 through 282.
	Exterior Weathersealing and Insulation:

7T-934-81	Buildings No. 100 through 113;
7T-958-81	Buildings No. 1, 2, 25, 26, 330;
7T-959-81	Buildings No. 27 through 34;
7T-960-81	Buildings No. 182 through 191;
7T-961-81	Buildings No. 172 through 181;
7T-962-81	Buildings No. 160 through 171;
7T-963-81	Buildings No. 150 through 155;
7T-964-81	Buildings No. 120 through 143;
7T-965-81	Buildings No. 210 through 282;
	Received job order requests.
7T-0990-81*	Replace windows and exterior weathersealing, Building No. 31.
7T-1024-81*	Convert steam heating to HW system, Building No. 233.
7T-1025-81*	Convert LP heating to HW, Building No. 700.
7T-1026-81*	Convert LP heating system to HW, Building No. 650.
7T-1027-81*	Convert LP heating system to HW, Building No. 31.
7T-1028-81*	Convert LP heating system to HW, Building No. 470.
7T-1035-81*	Install heating plant, Building No. 550.

* Project is unfunded or subject to available funds.

4.6 INCREMENT PROJECTS BY E/C RATIO

Table 10-1, Volume 6 of the Prefinal Submittal, ranks all the recommended Increment A, B, F and G projects by E/C ratio. A copy is included in this Summary.

4.7 FUTURE ENERGY CONSUMPTION

4.7.1 GENERAL

In this Section we have analyzed the effect of future facility changes on the energy consumption of the Wildflecken Subcommunity. Tables 11-1, 11-2 and 11-3 list the changes in construction in two categories: New Constructions and Demolitions. These tables are included in Appendix 11-B, Volume 7, Prefinal Submittal.

4.7.2 AVAILABLE DATA

Wildflecken did not have a formalized Master Plan so we developed our estimated future energy use from other data made available to us. The data consisted of:

a. 7ATC MCA Project Status Report, dated 10 February, 1982.

b. Building floor areas from 7ATC Master Planning Section, Grafenwoehr.

c. Design Energy Budgets listed in ETL 1110-3-295.

Since the average heating degree days (HDD) at Wildflcken is more than 7,000 per year, Climatic Region No. 1 was selected and used to determine the Design Energy budgets appropriate to the proposed facility changes.

4.7.3 ANALYSIS

The estimated energy usage of 760,581 sf of new construction is 56,180 MBtu/yr. This is equivalent to 12.7% of the total energy consumption of FY 80.

The estimated energy reduction from 36,722 sf of demolitions and 50,160 SF of conversions to unheated storage is 15,952 MBtu/yr. This is equivalent to 3.6% of the total energy consumption of FY 80.

Therefore, the net estimated future energy consumption for the Wildflecken Subcommunity is 40,228 MBtu/yr and results from all facilities changes planned up to and including FY 88. This is equivalent to a 9.1% increase in total energy consumption of FY 80.

It is assumed that all new construction will incorporate required energy conservative features in their designs.

4.8 TRAINING COURSES

We have presented in Section 12, Volume 6 of the Prefinal Submittal recommendations on Government and Commercial sponsored training courses. We recommend these courses as additional training for the Wildfflecken Facilities Engineer Division.

It is not our intent to suggest that this additional training be considered as basic training but rather as refresher or familiarization courses. Training is required to update current knowledge and to learn new technology.

The one course we strongly recommend is the Preventive Maintenance Seminar.

5. ENERGY CONSUMPTION ANALYSIS USING AXCESS COMPUTER PROGRAM (INCREMENTS A & G ONLY)

5.1 MODELING OF SURVEYED BUILDINGS

Each of the surveyed buildings has been modeled on the AXCESS Input Data Sheets, using field survey data, weather data supplied by EUD, occupancy schedules, building construction data, etc; and the model verified against historical energy use (when available) and adjusted until reasonable agreement is obtained.

5.2 COMPUTER OUTPUT

Each Output consists of three parts:

a. Input data

b. Design day space heat gain calculation, (based on 18^{o}C outside air temperature).

c. Result of the hour-by-hour AXCESS energy consumption calculations. The Result consists of a two page output.

The first page shows the month-by-month consumption values of:

1.	Total Source Energy	: MBtu
2.	Electricity	: kwh
3.	Anthracite Coal	: m-tons
4.	Fuel Oil No. 2	: gal
5.	Fuel Oil No. 6	: gal
6.	Interior Lights	: kwh
7.	Equipment	: kwh
8.	Misc. Equipment	: kwh
9.	Fan Power	: kwh
10.	Domestic Hot Water	: MBtu (source energy)

The second page shows the month-by-month consumption values of all the above 10 quantities in kBtu/yr/sf of building area.

It also indicates the annual percent of total energy consumption by each of the above 10 quantities.

5.3 UTILIZATION OF AXCESS RESULTS

As a result of making an AXCESS analysis of buildings of every type, the average kBtu/yr/sf of each building type has been determined.

Knowing the square foot area of all buildings of each type, energy consumed by all buildings of a given type has been calculated by extrapolation.

By analyzing all types of buildings, the energy consumed by all the buildings in the Subcommunity has been estimated.

5.4 AVERAGE ENERGY CONSUMPTION PER BUILDING TYPE

Based on the analysis of the surveyed buildings, the weighted average values of annual source energy consumption per square foot by each of the building types for space heating, domestic hot water, lighting and miscellaneous electric power, are shown in Table 5-1. In Table 5-2, the above values have been expressed as percentages of the total source energy per building type.

5.4.1 GENERAL COMMENTS

We observe that the average total source energy consumption is 146 kBtu/yr/sf of which 37 units (25%) are electrical and 109 units (75%) are fuel.

On an average, a building consumes 93 units for space heating, 15 for DHW, 14 for lighting and 24 for miscellaneous electrical equipment.

Five building types consume more than 150 kBtu/yr/sf for space heating; and as a result of the recommended energy conservation projects, these values will be significantly lowered.

5.5 TOTAL ENERGY CONSUMPTION PER BUILDING TYPE AND BY ENTIRE SUBCOMMUNITY

The annual values of total fuel (coal or oil) consumption (MBtuF), electricity consumption (MWH and equivalent source (MBtuE)) as well as total energy

ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE 29-SEP-82

PROGRAM LIST7

ENERGY CONSUMPTION : SUMMARIZED RESULTS OF AXCESS PROGRAM Table 5-1

WILDFLECKEN SUBCOMMUNITY

- AVERAGE ENERGY CONSUMPTION BY BLDG TYPE -
- KBTU PER SQUARE FOOT PER YEAR -

DESCRP	TYP	GSF	TOTAL ENERGY	FUEL	ELEC	SPACE HEAT	DHW	LIGHT	MISC	MISC LT/EQP	BOILER AUX	ACTUAL FUEL	
-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	
EM/BOQ	1	1150315.	93.1	78.2	14.9	67.4	10.7	8.1	6.8	5.2	1.6	72.4	
EM MESS	3	196769.	350.6	251.8	98.8	208.0	43.8	14.7	84.1	78.6	5.5	264.3	
FAM HSNG	5	580365.	153.6	93.8	59.8	75.4	18.4	19.0	40.8	38.3	2.6	104.6	
SCHOOL	7	47153.	121.7	91.5	30.1	87.6	3.9	19.5	10.7	6.1	4.6	91.4	
WAREHSE RF	8	62041.	117.1	82.1	35.0	78.9	3.2	9.9	25.1	23.9	1.2	75.6	
THEATER	9	10347.	304.8	243.3	61.5	240.9	2.4	3.2	58.3	30.3	28.0	262.3	
LAUNDRY	10	11559.	527.2	452.7	74.5	150.2	302.5	15.7	58.8	49.8	9.0	451.0	
MOTR RPR	11	158213.	189.7	144.9	44.8	131.7	13.2	29.5	15.3	1.7	13.6	152.6	
GYMNASUM	12	20050.	445.0	360.7	84.3	289.2	71.5	48.1	36.2	30.9	5.3	365.5	
CHAPEL	13	8941.	248.1	228.6	19.5	217.6	11.0	6.7	12.8	0.0	12.8	229.0	
COMISARY	15	40397.	243.9	191.8	52.1	186.1	5.7	18.9	33.2	22.6	10.6	190.7	
ADMINSTRA	16	194819.	130.5	107.0	23.5	99.3	7.7	14.6	8.9	2.0	7.0	109.5	
WAREHSE	18	146198.	138.7	102.7	36.0	97.8	4.9	11.2	24.8	7.3	17.5	113.3	
OFF MESS	19	128060.	185.3	127.9	57.3	119.3	8.6	17.8	39.5	33.8	5.7	127.8	
FIRE HSE	20	13126.	134.3	117.2	17.1	114.6	2.6	12.4	4.7	2.8	1.9	79.5	
DISPNSRY	21	28843.	132.0	106.2	25.8	72.2	34.0	18.5	7.3	4.6	2.7	124.4	
WEIGHTED AVERAGE			146.4	109.0	37.4	93.5	15.5	13.8	23.6	19.2	4.5	110.8	0.3

ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE 29-SEP-82

PROGRAM LIST7

ENERGY CONSUMPTION : SUMMARIZED RESULTS OF AXCESS PROGRAM Table 5-2

WILDFLECKEN SUBCOMMUNITY

- PERCENT ENERGY CONSUMPTION BY BLDG TYPE -

DESCRP	TYP	GSF	TOTAL ENERGY	FUEL	ELEC	SPACE HEAT	D+W	LIGHT	MISC:	MISC LT/EQP	BOILER AUX	ACTUAL FUEL
-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
EM/BOQ	1		100.0	84.0	16.0	72.5	11.5	8.7	7.3	5.6	1.7	77.7
EM MESS	3		100.0	71.8	28.2	59.3	12.5	4.2	24.0	22.4	1.6	75.4
FAM HSNG	5		100.0	61.1	38.9	49.1	12.0	12.4	26.6	24.9	1.7	68.1
SCHOOL	7		100.0	75.2	24.8	72.0	3.2	16.0	8.8	5.0	3.8	75.1
WRHSE RF	8		100.0	70.1	29.9	67.4	2.7	8.5	21.4	20.4	1.0	64.6
THEATER	9		100.0	79.8	20.2	79.0	0.8	1.0	19.1	9.9	9.2	86.1
LAUNDRY	10		100.0	85.9	14.1	28.5	57.4	3.0	11.2	9.4	1.7	85.5
MOTR RPR	11		100.0	76.4	23.6	69.5	6.9	15.6	8.0	0.9	7.2	80.5
GYM/ASLM	12		100.0	81.1	18.9	65.0	16.1	10.8	8.1	6.9	1.2	82.1
CHAPEL	13		100.0	92.1	7.9	87.7	4.4	2.7	5.2	0.0	5.2	92.3
COMISARY	15		100.0	78.6	21.4	76.3	2.3	7.8	13.6	9.3	4.3	78.2
ADMNSTRA	16		100.0	82.0	18.0	76.1	5.9	11.2	6.8	1.5	5.3	83.9
WAREHSE	18		100.0	74.0	26.0	70.5	3.5	8.1	17.9	5.3	12.6	81.7
OFF MESS	19		100.0	69.1	30.9	64.4	4.6	9.6	21.3	18.3	3.1	69.0
FIRE HSE	20		100.0	87.3	12.7	85.3	1.9	9.2	3.5	2.1	1.4	59.2
DISPNSRY	21		100.0	80.5	19.5	54.7	25.8	14.0	5.5	3.5	2.1	94.3
AVERAGE PERCENT			100.0	74.5	25.5	63.9	10.6	9.4	16.1	13.1	3.0	75.7

HEADING DEFINITIONS

Tables 5-1 and 5-2

COLUMN		EXPLANATION
-1-	DESCRP	: DESCRIPTION OF BUILDING TYPE
-2-	TYP	: DESIGNATED TYPE NUMBER FROM INCREMENT 'A'
-3-	GSF	: TOTAL GROSS SQUARE FOOTAGE FOR BUILDINGS OF THE PARTICULAR TYPE
-4-	TOTAL	: TOTAL ENERGY CONSUMPTION PER TYPE (KBTU/SF)PER YEAR COLUMN (5) + COLUMN (6)
-5-	FUEL	: TOTAL FUEL CONSUMPTION PER TYPE (KBTU/SF)PER YEAR COLUMN (7) + COLUMN (8)
-6-	ELEC	: TOTAL ELECTRICITY CONSUMPTION PER TYPE (KBTU/SF)PER YEAR COLUMN (9) + COLUMN (10)
-10-	MISC	: MISCELLANEOUS CONSUMPTION OF ELECTRICITY COLUMN (11) + COLUMN (12)
-11-	LT/EQP	: INCLUDES EXTERIOR LIGHTING AND EQUIPMENT SUCH AS LAUNDRY MACHINES, COOKING EQUIPMENT, AND MISCELLANEOUS HOUSEHOLD EQUIPMENT.
-12-	BOILER AUX	: INCLUDES BOILER PUMPS, BURNER MOTERS, UNIT HEATER FANS AND FURNACE FANS.
-13-	ACTUAL FUEL	: ACTUAL KNOWN FUEL CONSUMPTION. DOES NOT INCLUDE ELECTRICITY.

(fuel and electricity consumption (MBtuT)) by each type of building have been determined, as shown in Table 5-3, using the average values per building type and the GSF area of the type.

The "miscellaneous" consumption consists of the consumption by items such as Street Lighting, Sewage Treatment Plant and Water Pump Station.

Table 5-3 also shows the percent of total fuel, total electricity and total energy, consumed by each of the building types.

5.5.1 GENERAL COMMENTS

5.5.1.1 FUEL CONSUMPTION

We observe that the topmost consumers of fuel (coal and oil) are the following building types:

EM Barracks w/o Mess	= 29.2%
Family Housing	= 17.7%
EM Mess	= 16.1%
Motor/Tank Repair	= 7.4%
Administration	= 6.8%

These building types consume 77% of the total fuel.

5.5.1.2 ELECTRICITY CONSUMPTION

The leading consumers of electricty are the following building types:

Family Housing	= 35.5%
EM Mess	= 17.8%
EM Barracks w/o Mess	= 15.7%
Officers Mess/Club	= 6.7%
Motor/Tank Repair	= 6.5%
Warehouse	= 6.8%
Administration	= 4.2%

ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE : BASEWIDE EXTRAPOLATED ENERGY CONSUMPTION
PROGRAM LIST55 30-SEP-82
WILDFLECKEN SUBCOMMUNITY

Table 5-3

TYP	NO.	GSF	AVG PER SF/YR KBTUF	KBTUE	KBTUT	TOTAL PER YR MBTUF	MBTUE	KBTUT	PERCENTAGE FUEL	ELEC	TOTAL	GSF	DESCRIP
-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-
1	54.	1150315.	78.2	14.9	93.1	89932.	17151.	107083.	29.2	15.0	25.4	40.3	EM/BOQ
3	10.	196769.	251.8	98.8	350.6	49550.	19445.	68995.	16.1	17.0	16.3	6.9	EM MESS
5	48.	580365.	93.8	59.8	153.6	54456.	34712.	89167.	17.7	30.4	21.1	20.3	FAM HSNG
7	4.	47153.	91.5	30.1	121.7	4316.	1422.	5738.	1.4	1.2	1.4	1.7	SCHOOL
8	1.	62041.	82.1	35.0	117.1	5094.	2171.	7265.	1.7	1.9	1.7	2.2	WRHSE RF
9	1.	10347.	243.3	61.5	304.8	2517.	636.	3154.	0.8	0.6	0.7	0.4	THEATER
10	1.	11559.	452.7	74.5	527.2	5233.	861.	6094.	1.7	0.8	1.4	0.4	LAUNDRY
11	19.	158213.	144.9	44.8	189.6	22925.	7080.	30005.	7.4	6.2	7.1	5.5	MOTR RPR
12	1.	20050.	360.7	84.3	445.0	7232.	1690.	8922.	2.3	1.5	2.1	0.7	GYMNASUM
13	2.	8941.	228.6	19.5	248.1	2044.	174.	2218.	0.7	0.2	0.5	0.3	CHAPEL
15	3.	40397.	191.8	52.1	243.9	7748.	2106.	9854.	2.5	1.8	2.3	1.4	COMISARY
16	14.	194819.	107.0	23.5	130.5	20840.	4578.	25418.	6.8	4.0	6.0	6.8	ADMNSTRA
18	12.	146198.	102.7	36.0	138.7	15015.	5263.	20278.	4.9	4.6	4.8	5.1	WRHSE
19	5.	128060.	127.9	57.3	185.3	16384.	7339.	23723.	5.3	6.4	5.6	4.5	OFF MESS
20	1.	13126.	117.2	17.1	134.3	1538.	224.	1763.	0.5	0.2	0.4	0.5	FIRE HSE
21	2.	28843.	106.2	25.8	132.0	3063.	743.	3807.	1.0	0.7	0.9	1.0	DISPNSRY
25	4.	0.	0.0	0.0	0.0	0.	8727.	8727.	0.0	7.6	2.1	1.0	MISCELL
	184.	2854010.	107.9	40.1	147.9	307887.	114324.	422211.	100.0	100.0	100.0	100.0	EXTRAPO. VALUES
			108.2	48.3	156.5	305796.	136565.	442361.	100.0	100.0	100.0	100.0	FY 1980 VALUES

TYP	NO.	GSF	KBTUF	KBTUE	KBTUT	MBTUF	MBTUE	KBTUT	FUEL	ELEC	TOTAL	GSF	DESCRIP
-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-

HEADING DEFINITIONS

1. TYP : BUILDING TYPE AS DEFINED BY INCREMENT 'A'
2. NO. : TOTAL NUMBER OF BUILDINGS PER TYPE
3. GSF : TOTAL GROSS SQUARE FOOTAGE PER TYPE
4. KBTUF : AVERAGE YEARLY CONSUMPTION OF FUEL (COAL/OIL) ON A PER SQUARE FOOT BASIS IN KBTU (BTU*1000)
5. KBTUE : AVERAGE YEARLY CONSUMPTION OF ELECTRICITY ON A PER SQUARE FOOT BASIS IN KBTU (BTU*1000)
6. KBTUT : AVERAGE YEARLY ENERGY CONSUMPTION ON A PER SQUARE FOOT BASIS IN KBTU (BTU*1000)
   COLUMN (4) + COLUMN (5)
7. MBTUF : TOTAL YEARLY FUEL (COAL/OIL) CONSUMPTION IN MBTU (BTU*1000000)
   COLUMN (3) X COLUMN (4)
8. MBTUE : TOTAL YEARLY ELECTRICITY CONSUMPTION IN MBTU (BTU*1000000)
   COLUMN (3) X COLUMN (5)
9. MBTUT : TOTAL YEARLY ENERGY CONSUMPTION IN MBTU (BTU*1000000)
   COLUMN (3) X COLUMN (6)

PERCENTAGE :

10. FUEL : PERCENT OF FUEL CONSUMED IN RELATION TO TOTAL BASE CONSUMPTION
    COL. (7) X 100/COMMUNITY FUEL CONSUMPTION
11. ELEC : PERCENT OF ELECTRICITY CONSUMED IN RELATION TO TOTAL BASE CONSUMPTION
    COL. (8) X 100/COMMUNITY ELEC. CONSUMPTION
12. TOTAL : PERCENT OF TOTAL ENERGY CONSUMED IN RELATION TO TOTAL BASE CONSUMPTION
    COL. (9) X 100/TOTAL COMMUNITY ENERGY CONSUMPTION
13. GSF : PERCENT OF GROSS SQUARE FOOTAGE IN RELATION TO TOTAL BASE SQUARE FOOTAGE
    COL. (3) X 100/COMMUNITY GSF
14. DESCRIP : DESCRIPTION OF BUILDING USE PER TYPE

These building types consume 90% of the total electricity consumption.

5.6 PRESENT AND PROJECTED ENERGY COSTS

Based on the average energy consumption values obtained we have developed and shown the present FY 80 as well as projected FY 84 energy costs (if no energy conservation actions are implemented) for space heating, DHW, lighting, miscellaneous, and total energy for each building type in Tables 5-4A and 5-4B.

5.6.1 GENERAL COMMENTS

We observe that on an average, the annual energy cost is 94 cents per square foot, of which 64 cents is for space heating, 11 cents is for DHW, 7 cents for lighting and 12 cents for miscellaneous electrical equipment such as boiler pumps, unit heater fans, washing machines and stoves.

Between FY 1980 and FY 1984, the energy cost will increase by a factor of 1.6 if no energy conservation measures are implemented; i.e., the annual energy cost will increase from approximately $2.6 million to $4.2 million.

ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE 29-SEP-82
PROGRAM LIST6
WILDFLECKEN SUBCOMMUNITY Table 5-4A

ENERGY COST-1980: CENTS/SQ FT

FUEL COST : $ 6.86/MBTU ELECTRIC COST : $ 5.11/MBTU

BLDG TYPE	BLDG DESC	GSF	FUEL: SPACE HEAT	FUEL: DHW	ELECTRICITY: LIGHTS	ELECTRICITY: MISC	TOTAL
			CENTS/SQ FT, 1980				
1	EM/BOQ	1150315.	46.	7.	4.	3.	61.
3	EM MESS	196769.	143.	30.	6.	43.	223.
5	FAM HSNG	580365.	52.	13.	10.	21.	95.
7	SCHOOL	47153.	60.	3.	10.	5.	78.
8	WRHSE RF	62041.	54.	2.	5.	13.	74.
9	THEATER	10347.	165.	2.	2.	30.	198.
10	LAUNDRY	11559.	103.	208.	8.	30.	349.
11	MOTR RPR	156213.	90.	9.	15.	8.	122.
12	GYMNASUM	20050.	196.	49.	25.	18.	291.
13	CHAPEL	8941.	149.	8.	3.	7.	167.
15	COMISARY	40397.	128.	4.	10.	17.	158.
16	ADMNSTRA	194819.	68.	5.	7.	5.	85.
18	WRHSE	146198.	67.	3.	6.	13.	89.
19	OFF MESS	128060.	82.	6.	9.	20.	117.
20	FIRE HSE	13126.	79.	2.	6.	2.	89.
21	DISPNSRY	28843.	50.	23.	9.	4.	86.
	AVERAGE		64.	11.	7.	12.	94.

ENERGY ENGINEERING ANALYSIS PROGRAM, EUROPE 29-SEP-82
PROGRAM LIST6
WILDFLECKEN SUBCOMMUNITY Table 5-4B

ENERGY COST-1984: CENTS/SQ FT

FUEL COST : $ 11.18/KBTU ELECTRIC COST : $ 8.32/KBTU

BLDG TYPE	BLDG DESC	GSF	FUEL SPACE HEAT	FUEL DHW	ELECTRICITY LIGHTS	ELECTRICITY MISC	TOTAL
			CENTS/SQ FT, 1984				
1	EM/BOQ	1150315.	75.	12.	7.	6.	100.
3	EM MESS	196769.	233.	49.	12.	70.	364.
5	FAM HSNG	580365.	84.	21.	16.	34.	155.
7	SCHOOL	47153.	98.	4.	16.	9.	127.
8	WRHSE RF	62041.	88.	4.	8.	21.	121.
9	THEATER	10347.	269.	3.	3.	49.	323.
10	LAUNDRY	11559.	168.	338.	13.	49.	568.
11	MOTR RPR	158213.	147.	15.	25.	13.	199.
12	GYMNASUM	20050.	323.	80.	40.	30.	473.
13	CHAPEL	8941.	243.	12.	6.	11.	272.
15	COMISARY	40397.	208.	6.	16.	28.	258.
16	ADMNSTRA	194819.	111.	9.	12.	7.	139.
18	WRHSE	146198.	109.	5.	9.	21.	145.
19	OFF MESS	128060.	133.	10.	15.	33.	191.
20	FIRE HSE	13126.	128.	3.	10.	4.	145.
21	DISPNSRY	28643.	81.	38.	15.	6.	140.
	AVERAGE		105.	17.	11.	20.	153.

6. INFORMATION RECEIVED FROM SUBCOMMUNITY

We have presented in Section 2 of the Energy Report details of the following:

a. Drawings

b. Utility and Fuel Bills

c. Information of Previous Studies

d. Building Information Schedule

e. Basic Utility System Maps

f. Facility Engineering Technical Data Report

g. Subcommunity Fixed Facility Energy Plan

h. Land Use Plan and Planned Physical Plant Expansion Data

i. Population Data

7. ENERGY CONSUMPTION DATA AND SUBCOMMUNITY GOALS

Presented herein are the following tables:

Table 3.3-1 Fuel and Electricity Prices

Table 3.3-2 Annual Energy Consumption and Cost Profile for FY 75, 78, 79 and 80

Table 3.2-1 Energy Consumption Goals for FY 85

Table 3.4 Wildflecken Typical Building Energy Consumption

WILDFLECKEN

Table 3.3-1

FY 84 FUEL PRICES, BASED ON FUEL PRICES IN FY 81

FUEL	UNIT	FY 81		FY 84	
		$/UNIT	$/MBTU	$/UNIT	$/MBTU
ELECTRICITY	KWH	0.07	6.034	0.10	8.706
COAL	m-TON	127	4.071	169	5.419
NO. 2 OIL	GAL	1.22	8.796	1.81	13.032
NO. 6 OIL	GAL	--	--	--	--
ELECTRIC DEMAND	KVA	10.00	--	14.428	--

CONVERSION FACTORS: $(10)^6 \frac{BTU}{MBTU}$

$0.0116 \frac{MBTU\ ELECTRICITY}{KWH}$

$31.2 \frac{MBTU\ COAL}{m\text{-}TON}$

$0.1387 \frac{MBTU\ NO.\ 2\ OIL}{GAL}$

$0.1485 \frac{MBTU\ NO.\ 6\ OIL}{GAL}$

ATTACHMENT TO TABLE 3.3-1

BACKUP - USEFUL DATA

ANNUAL ESCALATION RATES PER "ECIP"				
FUEL	FY 81	FY 82	FY 83	FY 84
ELECTRICITY	13%	13%	13%	13%
COAL	10%	10%	10%	10%
OIL	14%	14%	14%	14%

CONVERSION FACTORS
1 US DOLLAR = 2 DM
28.3 Mbtu/short ton of Anthracite Coal
1 short ton = 907.1847 kg
1 m-ton = 1000.0000 kg
1 gallon = 3.785 liters
1 US DOLLAR per gallon = 0.5284 DM per liter

TABLE 3.3-2

ANNUAL ENERGY CONSUMPTION AND COST PROFILE -- WILDFLECKEN

FUEL	NON REIMB OR REIMB	ENERGY MBTU/UNIT	UNIT	CONSUMPTION IN UNITS				CONSUMPTION IN MBTU				CONSUMPTION COST IN U.S. DOLLARS			
				FY 75	FY 78	FY 79	FY 80	FY 75	FY 78	FY 79	FY 80	FY 75	FY 78	FY 79	FY 80
ELECTRICITY (TOTAL)	NON REIMB	0.0116	KWH	7,189,435	8,610,539	8,820,662	9,679,636	83,397	99,882	102,320	112,284	310,125	518,095	460,818	574,562
	REIMB			1,554,709	1,862,021	1,907,460	2,093,232	18,035	21,599	22,127	24,281	66,240	110,661	98,427	122,705
	TOTAL			8,744,144	10,472,560	10,728,122	11,772,868	101,432	121,481	124,447	136,565	376,365	628,756	559,245	697,267
ANTH COAL	NON REIMB	31.2	M-TON												
	REIMB														
	TOTAL			3,668	3,650	3,260	3,300	114,442	113,880	101,712	102,960	262893	301726	278013	312,519
OIL NO. 2	NON REIMB	0.1387	GAL												
	REIMB														
	TOTAL			1,402,480	1630646	1399987	1462405	194,524	226,171	194178	202856	577,424	748,007	824,734	1,785,531
OIL NO. 6	NON REIMB	0.1485	GAL												
	REIMB														
	TOTAL														
TOTAL	NON REIMB														
	REIMB														
	TOTAL							410398	461532	420337	442361	1216682	1678489	1661992	2795317
ELECTRICITY PEAK DEMAND	NON REIMB		KW												
	REIMB														
	TOTAL			1,364	1,826	1,744	2,194					107427	172566	150020	204,155
ELECTRICITY MINIMUM POWER FACTOR	NON REIMB														
	REIMB														
	TOTAL			0.927	0.886	0.902	0.8714								
GROSS Floor Area (KSF)								2681			3061				
KBTU/ SF								153.1			144.5				
POPULATION								4850			6578				
KBTU/POPULATION								84618			67249				
DEGREE DAYS									7559	7760	7693				

Notes:
1. Boxed data is based on extrapolation.
2. Minimum permissible power factor = 0.9285
3. Sum of monthly peak demands for FY 80 = 23,710 kw
4. 1 US Dollar = 2 DM

TABLE 3.2-1 ENERGY CONSUMPTION: PROGRESS AND GOALS FOR FY 85: WILDFLECKEN

		UNITS	FY75	FY80	FY85
1a.	Electricity	MBTU	101,432	136,565	
b.	Coal	MBTU	114,442	102,960	37,104 Goal (10%)
c.	Fuel Oil # 2	MBTU	194,524	202,836	
d.	Fuel Oil # 6	MBTU	-	-	
e.	Solar Energy	MBTU	-	-	3,712 Goal (1%)
f.	Total Energy	MBTU	410,398	442,361	-
2a.	Goal: Total Energy Reduced 25%: (0.75 x $1f_{FY75}$)	MBTU	-	-	307,799
b.	Goal: Energy Per Sq. Ft. Reduced 20% by ECIPS and Mgmt, and 5% by New Efficient Bldgs (3a x 3c) + (4a x 4b)	MBTU	-	-	371,045
3a.	Building Area in use, constructed before FY 78	SQ.FT.	2,680,573	2,876,158	2,844,158
b.	Energy Per Sq. Ft. (1f ÷ 3a)	KBTU/SQ. FT.	153	-	-
c.	Goal: Energy Per Sq. Ft. Reduced 20% by ECIPS (12%), and Mgmt (8%): (0.8 x $3b_{FY75}$)	KBTU/SQ. FT.	-	-	122
d.	Total Energy	MBTU	410,398	-	346,987
4a.	Building Area in use, constructed after FY 78	SQ.FT.	-	185,081	286,406
b.	Goal: Energy Per Sq. Ft. Reduced 45% by Efficient Design (0.55 x $3b_{FY75}$)	KBTU/SQ. FT.	-		84
c.	Total Energy	MBTU	-		24,058
5a.	Gross Floor Area (3a + 4a)	SQ.FT.	2,680,573	3,061,239	3,130,564
b.	Energy Per Sq. Ft (1f ÷ 5a)	KBTU/SQ. FT.	153	144	-
c.	Goal: 25% Reduction (0.75 x $5b_{FY75}$)	KBTU/SQ. FT.	-	-	114
d.	Goal: Army Facilities Energy Plan, Annex B-5	KBTU/SQ. FT.	-	-	135
6a.	Heating Degree Days	DEG F - DAYS		7,693	
7A.	Population		4,850	6,578	7,050

TABLE 3.4
WILDFLECKEN TYPICAL BUILDING
ENERGY CONSUMPTION

TYPE	No.	DESCRIPTION	MBTU/YR ELEC	FUEL
1	151	EM BARRACKS WO/MESS	207	1665
3	260	EM MESS	2156	5800
5	54	FAMILY HOUSING	791	1505
7	81	DEPENDENT GRADE SCHOOL	280	1365
8	700	REFRIGERATED WAREHOUSE	2170	4690
9	16	THEATER	638	2174
10	233	LAUNDRY	861	5213
11	620	MOTOR/TANK REPAIR	132	1457
12	630	GYMNASIUM	1690	7328
13	352	CHAPEL	82	967
15	271	COMMISARY/RETAIL STORE	598	2500
16	410	ADMINISTRATION	166	1055
18	705	STOREHOUSE/WAREHOUSE	485	1530
19	50	OPEN MESS/NCO	1740	1582
20	430	FIRE STATION	225	1043
21	4	DISPENSARY	381	1665

8. DATA COLLECTED BY BUILDING SURVEY AND SELECTION OF REPRESENTATIVE BUILDINGS (INCREMENTS A & G ONLY)

The following data has been presented in detail in the Energy report and was orignally presented in the Preliminary Submittal:

Building Envelope Construction Data.

Occupancy, Lighting, Equipment and DHW Data.

Terminal Heating Systems and Control Data.

Primary Heating Systems Data.

Possible Energy Conservation Opportunities.

We have presented in the following table an updated list of representative buildings of each type selected for detailed Energy Conservation Analysis. In some types, we have selected more than one building for analysis in order to obtain more realistic basewide extrapolated ECIP or OMA projects.

TABLE 4.8

REPRESENTATIVE BUILDINGS OF EACH TYPE

WILDFLECKEN

TYPE	BUILDING TYPE DESCRIPTION	BUILDING
1	EM BARRACKS W/O MESS, BOQ	151
3	EM MESS	260
5	FAMILY HOUSING	36, 59, 96
7	DEPENDENT GRADE SCHOOL	81
8	WAREHOUSE-REFRIGERATED	700
9	THEATRE	16
10	LAUNDRY	233
11	MOTOR/TANK REPAIR SHOP	251, 620
12	GYMNASIUM	630
13	CHAPEL	352
15	RETAIL STORE/COMMISSARY	271
16	ADMINISTRATION	410, 642
18	STOREHOUSE/WAREHOUSE	705
19	OPEN MESS NCO/CLUB	50
20	FIRE STATION	430
21	DISPENSARY	4